REDUCING UNCERTAINTY IN COMPARATIVE RISK ASSESSMENTS — RESEARCH THAT MAKES A DIFFERENCE

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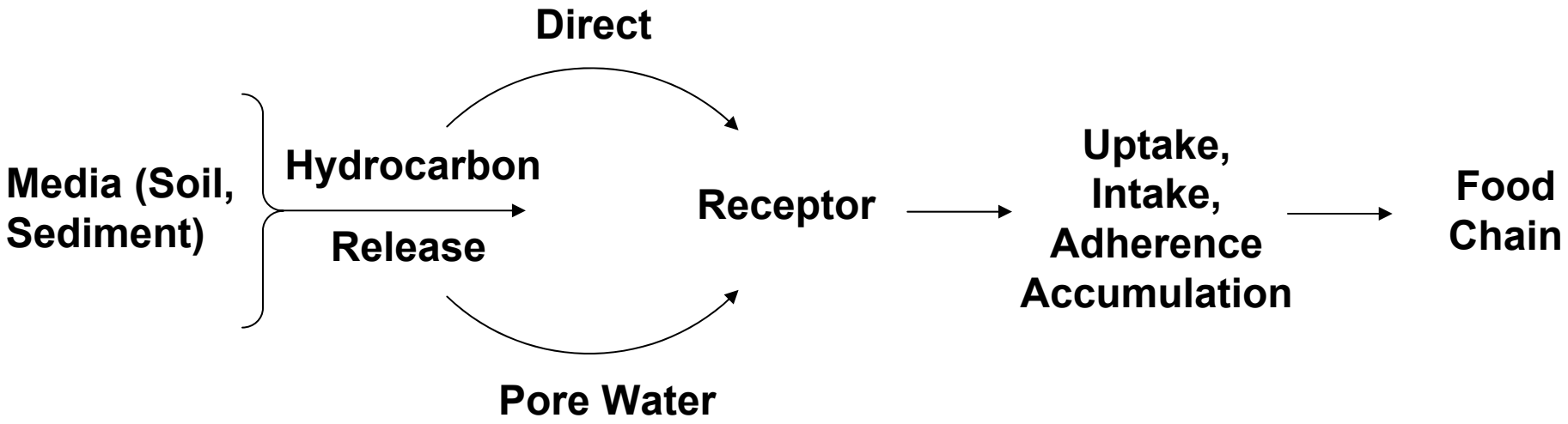
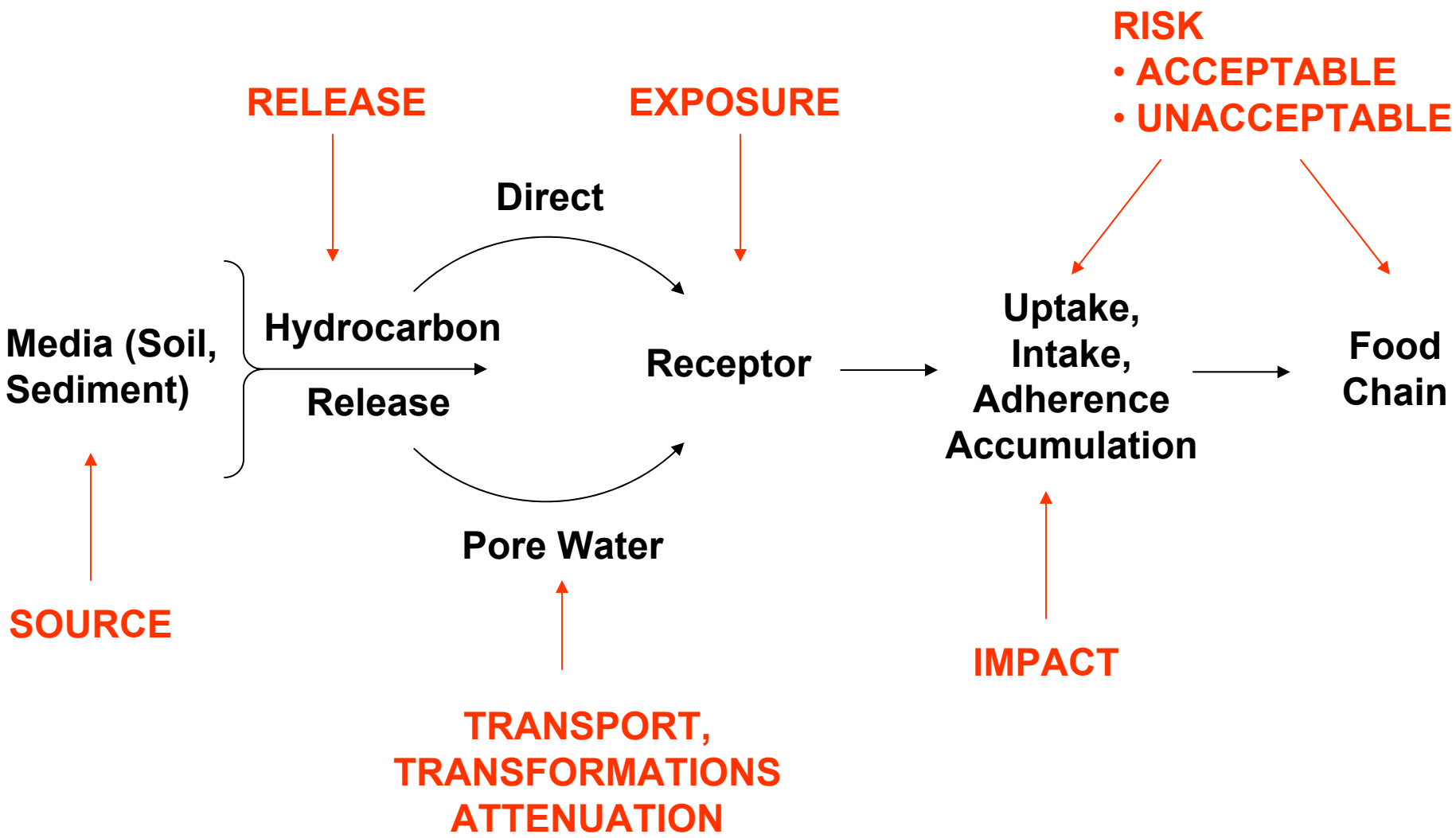
September 29, 2004
Oakland, CA

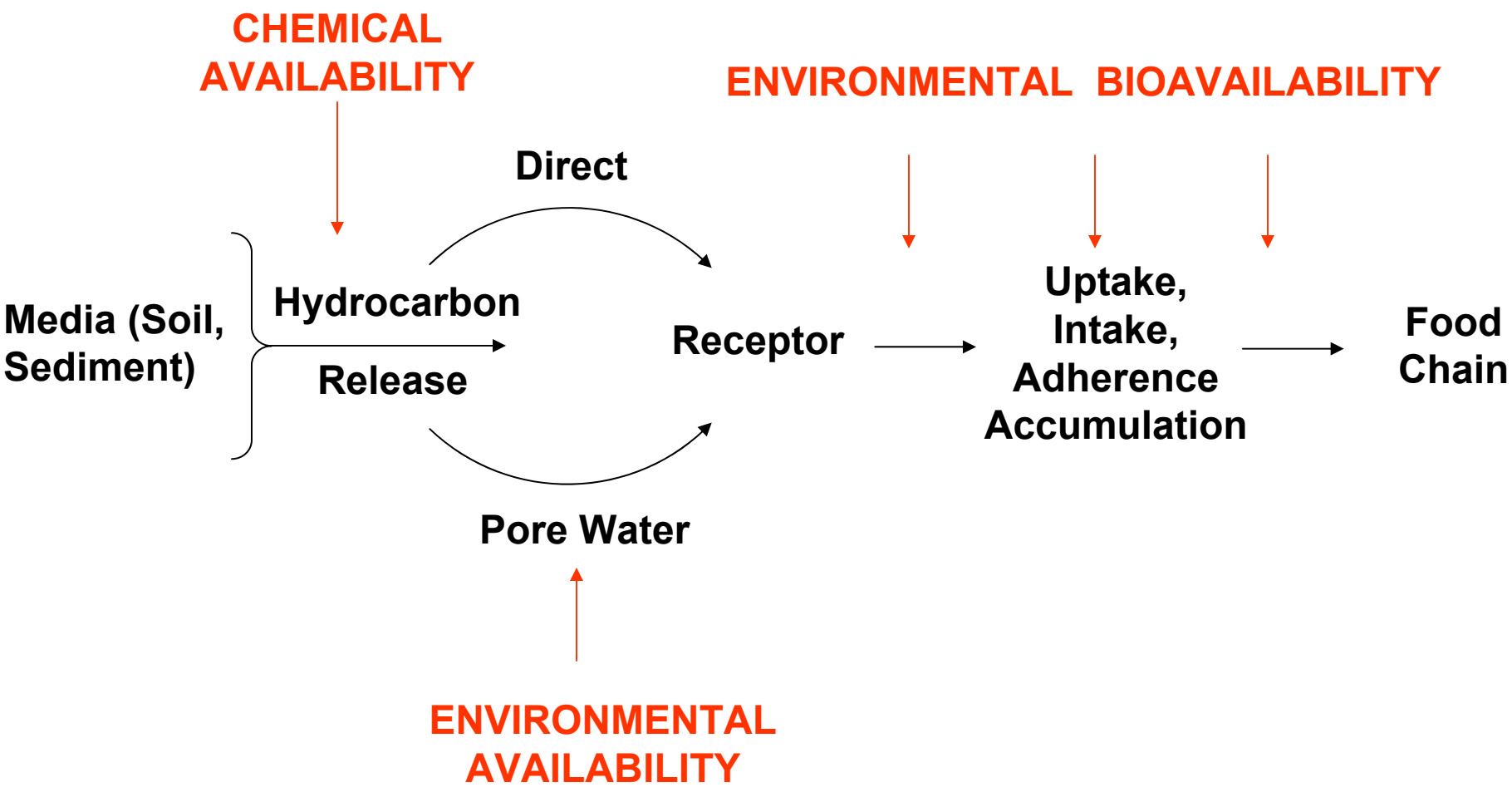
OVERVIEW

- MEDIA CONTAINING PETROLEUM HYDROCARBONS
- PERSPECTIVES AND CONTEXT
- TOPICS AND DIRECTIONS
- STIMULATE DISCUSSION
- HELP FOCUS STRATEGY
- 20,000 FOOT VIEW



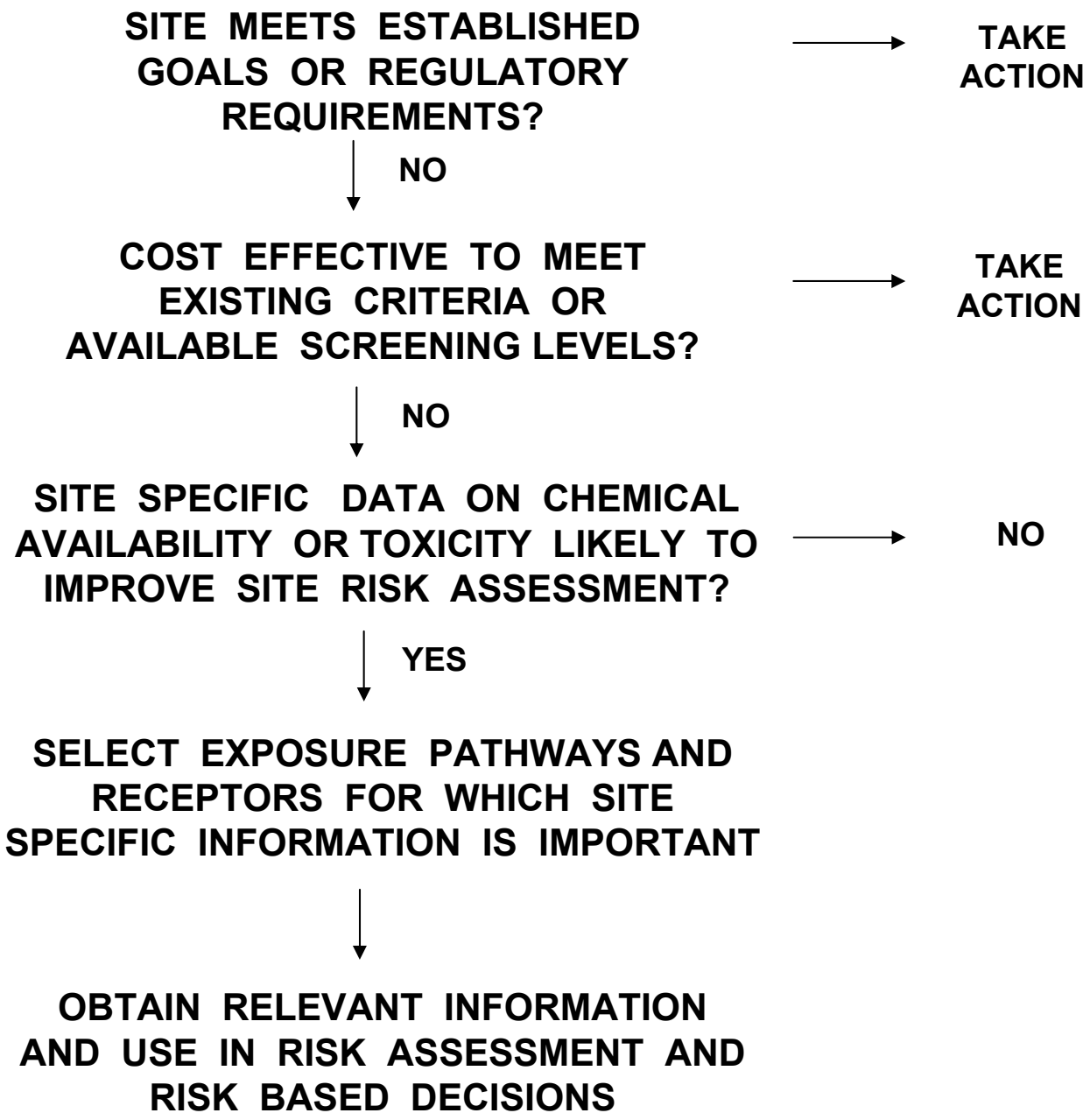
SIMPLISTIC PATHWAY ASSESSMENT

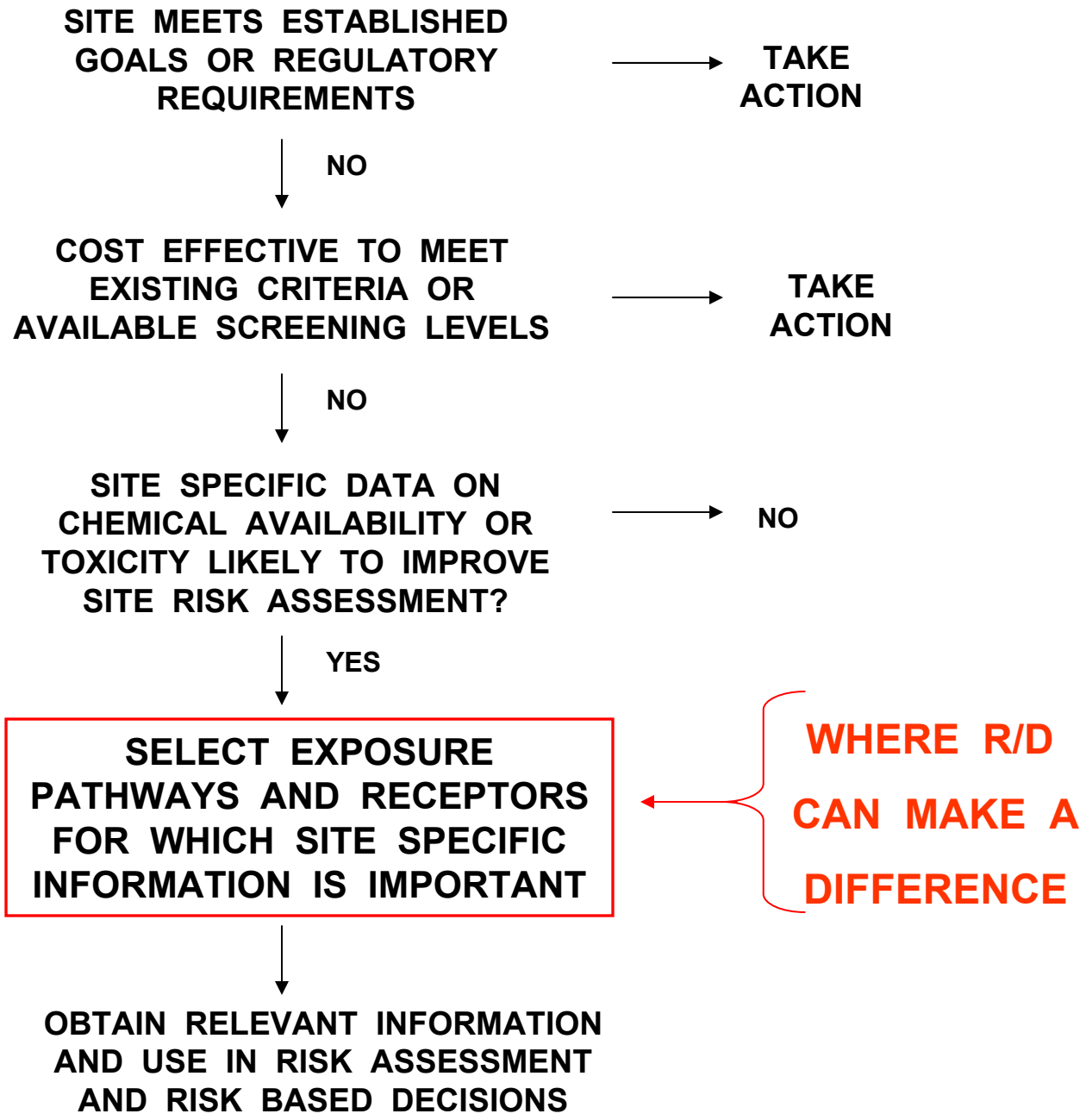

RISK
• ACCEPTABLE
• UNACCEPTABLE
RELEASE
EXPOSURE
Direct
Media (Soil, Sediment)
Hydrocarbon
Release
Receptor
Uptake, Intake, Adherence Accumulation
Food Chain
Pore Water
SOURCE
IMPACT
TRANSPORT, TRANSFORMATIONS ATTENUATION


CHEMICAL AVAILABILITY
ENVIRONMENTAL BIOAVAILABILITY
Direct
Media (Soil, Sediment)
Hydrocarbon
Release
Receptor
Uptake, Intake, Adherence Accumulation
Food Chain
Pore Water
ENVIRONMENTAL AVAILABILITY

R/D FOCUS

- CONTINUED PROTECTION OF HHE
- “USE INSPIRED” R/D WITH REAL WORLD SAMPLES AND SCENARIOS
- REDUCE UNCERTAINTIES IN KEY ASSUMPTIONS AND DEFAULT VALUES
- MAKE A DIFFERENCE BEFORE THE DECIMAL POINT 00.00
- FINITE RESOURCES


SITE MEETS ESTABLISHED GOALS OR REGULATORY REQUIREMENTS?
TAKE ACTION
NO
COST EFFECTIVE TO MEET EXISTING CRITERIA OR AVAILABLE SCREENING LEVELS?
TAKE ACTION
NO
SITE SPECIFIC DATA ON CHEMICAL AVAILABILITY OR TOXICITY LIKELY TO IMPROVE SITE RISK ASSESSMENT?
NO
YES
SELECT EXPOSURE PATHWAYS AND RECEPTORS FOR WHICH SITE SPECIFIC INFORMATION IS IMPORTANT
OBTAIN RELEVANT INFORMATION AND USE IN RISK ASSESSMENT AND RISK BASED DECISIONS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SELECT EXPOSURE PATHWAYS AND RECEPTORS FOR WHICH SITE SPECIFIC INFORMATION IS IMPORTANT
WHERE R/D CAN MAKE A DIFFERENCE
OBTAIN RELEVANT INFORMATION AND USE IN RISK ASSESSMENT AND RISK BASED DECISIONS

PETROLEUM HYDROCARBONS

- CRUDE OIL (C20 – C48)
- HEAVY FUEL OILS (C19 – C25)
- DIESEL AND FUEL OILS (C13 – C17)
- KEROSENE AND JET FUELS (C11 – C13)
- GASOLINE (C5 – C10)
- LOW PAH

DIFFERENT HYDROCARBONS HAVE DIFFERENT

- BOILING POINTS
- PARTITIONING COEFFICIENTS
- RELEASE FACTORS
- VOLATILITY, SOLUBILITY, MOBILITY

FACTORS AFFECTING IMPACT INCLUDE

- FRESH SPILL
- WEATHERING / AGING
- OTHER CONSTITUENTS
- NAPL EFFECT
- MEDIA CHARACTERISTICS

WHAT HAS BEEN LEARNED ??

- HYDROCARBON CONCENTRATION DATA DO NOT CORRELATE TO TOXICITY OR IMPACT OR EVEN IMPLY CONTAMINATION
- IMPORTANT TO EVALUATE REAL WORLD SITE SAMPLES, PATHWAYS AND RISK SCENARIOS
- NOT ALL HYDROCARBONS ARE RELEASED RAPIDLY OR FULLY
- HYDROCARBONS IN A SOIL ARE NOT EQUALLY ENVIRONMENTALLY AVAILABLE

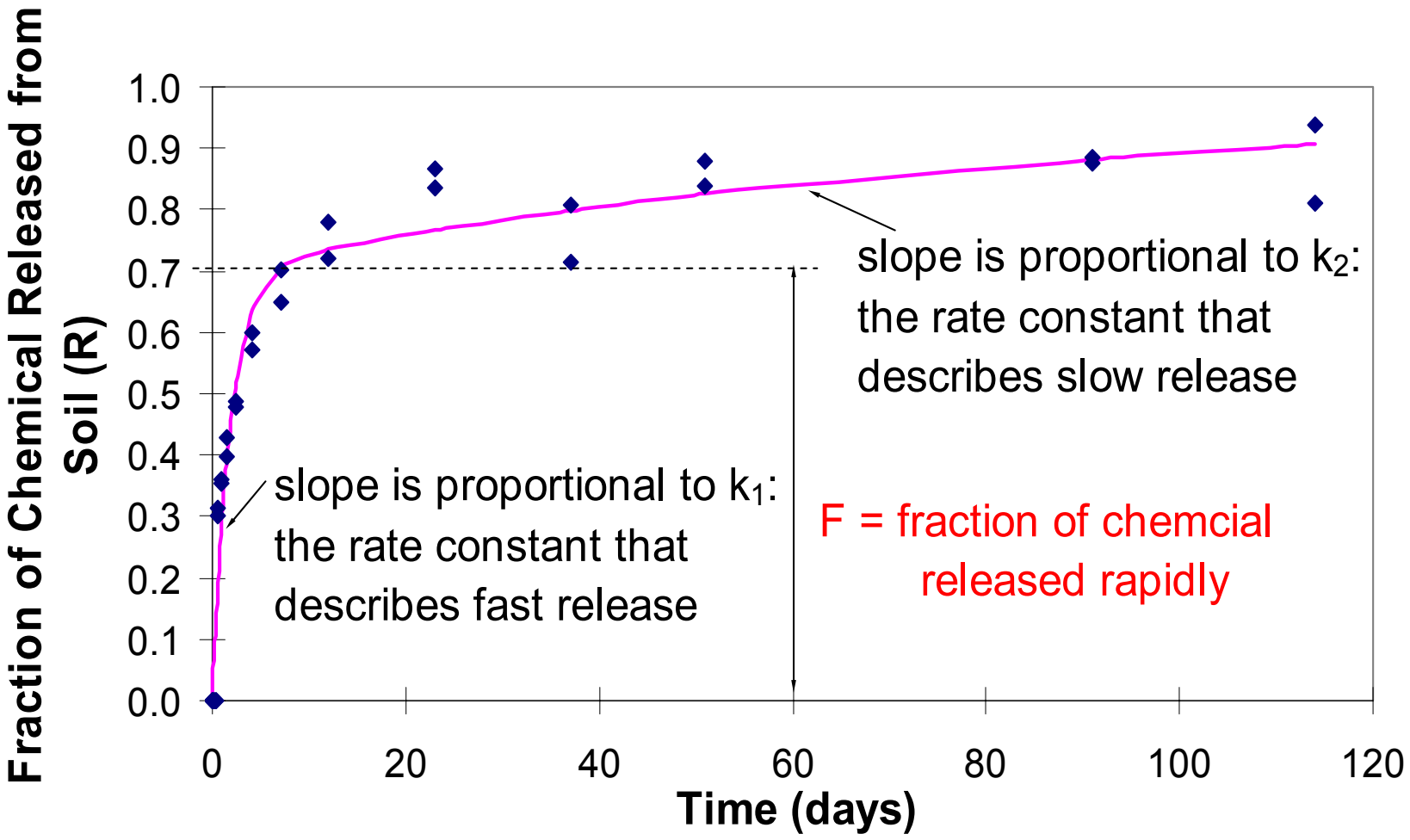
WHAT HAS BEEN LEARNED??

- PARTITIONING OF "REAL WORLD" TPH IS GREATER THAN THAT OF SPIKED TPH
- STRONGER SORPTION REDUCES CHEMICAL RELEASE AND BIOAVAILABILITY TO SOIL AND BENTHIC LIFE
- HYDROPHOBIC CHEMICALS ARE ASSOCIATED WITH ORGANIC MATTER AND ORGANIC SORBENTS
- SUCH SORBENTS ARE BEING CONSIDERED AS PART OF ACTIVE CAPS FOR SEDIMENTS
  - activated carbon, coke, organoclays

WHAT HAS BEEN LEARNED ??

- CHEMICAL RELEASE AND AVAILABILITY DEPEND ON THE TYPE OF SORBENT (CARBON) IN THE MEDIA
- ANTHROPOGENIC CARBON BINDS HYDROCARBONS 10 TO 100 TIMES GREATER THAN NATURAL ORGANIC CARBON
- CHEMICAL RELEASE CAN BE DEPICTED AS FAST RELEASE (F VALUE) FOLLOWED BY A SLOW RELEASE RATE (k2)

ILLUSTRATVE CHEMICAL RELEASE CURVE



ILLUSTRATIVE

CHEMICAL RELEASE DATA - -

PETROLEUM HYDROCARBONS

SOURCE	SOIL	HYDRO-CARBON	F VALUE
REFINERY SITE	SANDY SILT	C 20	0.11
	SANDY SILT	C 32	0.02
	SANDY SILT	MRO	0.09
CRUDE OIL STORAGE SITE	CLAYEY	MRO	0.04
INDUSTRIAL	SANDY SILT	C 10	0.40
	SANDY SILT	C 20	0.45
	SANDY SILT	C 25	0.05

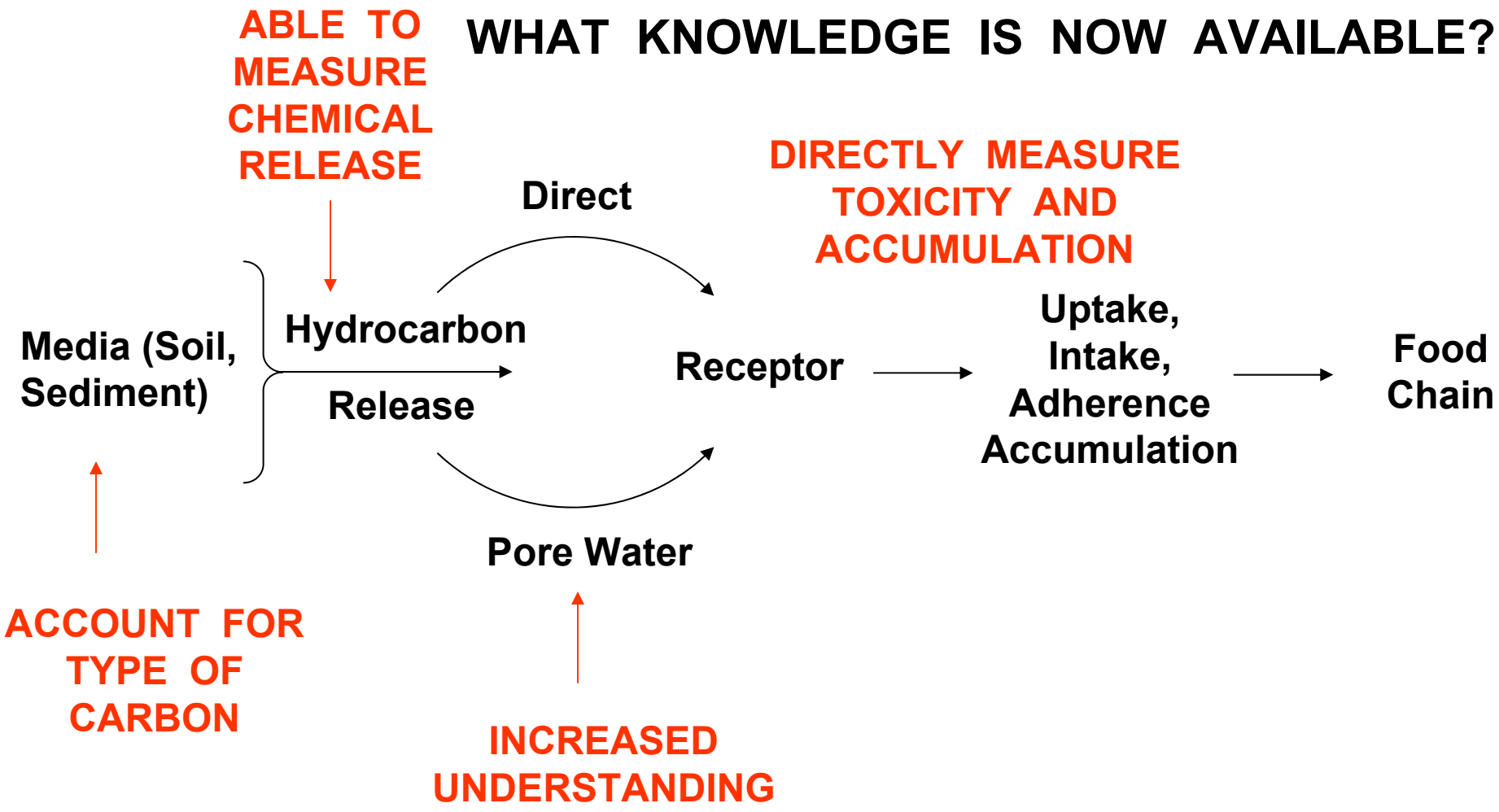
FACTORS AFFECTING THE MAGNITUDE OF THE F VALUE INCLUDE

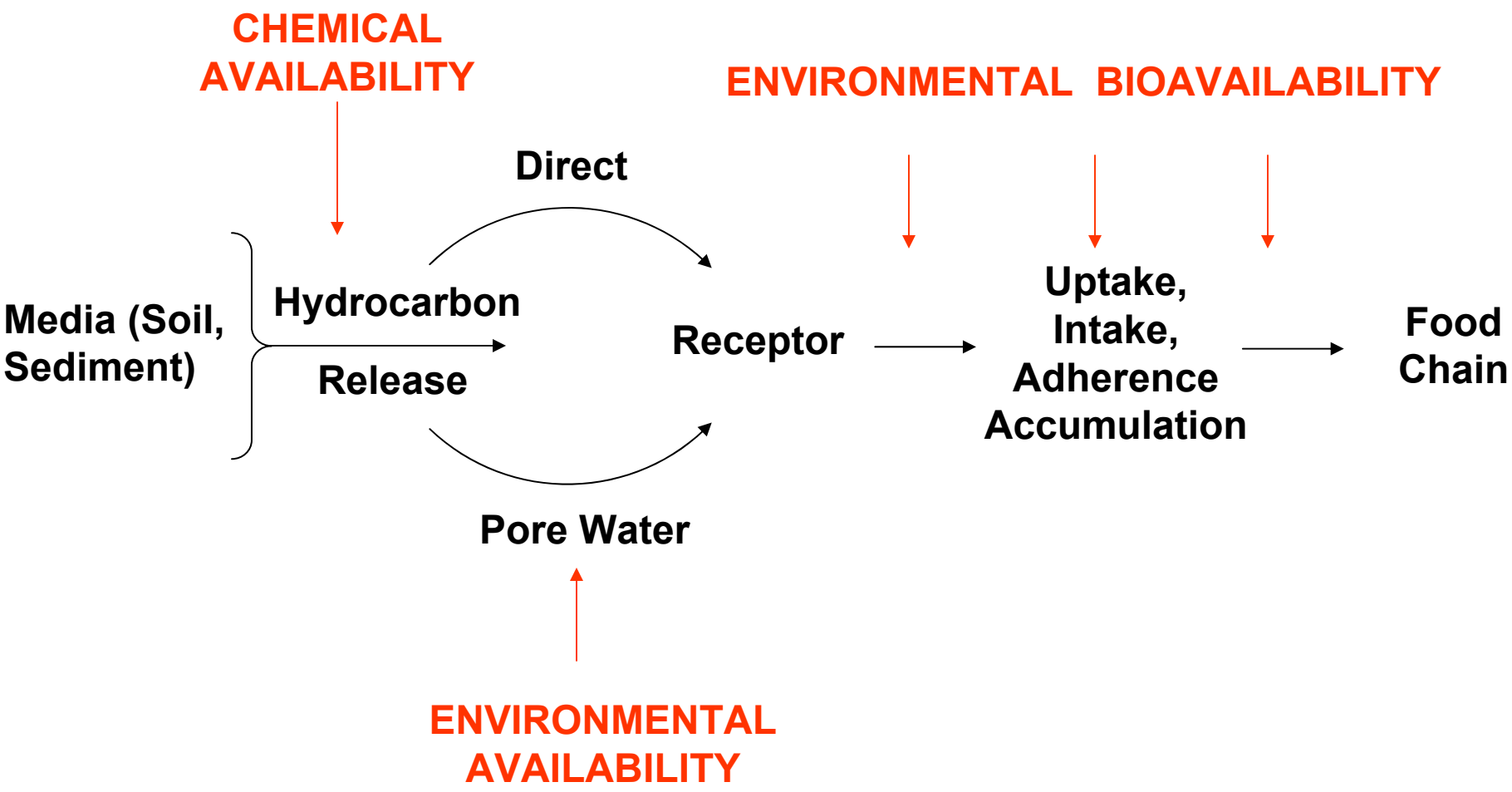
- FRESH SPILL
- WEATHERING
- HYDROCARBON CHARACTERISTICS
- MEDIA CHARACTERISTICS
  - SORPTIVE NATURE
  - OM, CLAY
  - CARBON
- NAPL EFFECT

WHAT HAS BEEN LEARNED ??

- ANALYTICAL PROCEDURES EXIST TO DETERMINE F AND k2 VALUES --- SFE, WATER DESORPTION
- EMPIRICALLY, USE OF THE F VALUE APPEARS TO HELP IMPROVE RELATIVE RISK EVALUATIONS OF HYDROCARBON CONTAINING MEDIA
- AN APPARENT RELATIONSHIP BETWEEN FRACTION OF HYDROCARBON RAPIDLY RELEASED AND THE BIODEGRADABLE FRACTION OF THE HYDROCARBON

WHAT KNOWLEDGE IS NOW AVAILABLE?

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ENVIRONMENTAL AVAILABILITY

MAJOR POINTS FOR R / D STRATEGY

- CONTINUE TO PROTECT HHE
- AVOID ISSUES OF THE MOMENT
- DECREASE IMPORTANT UNCERTAINTIES
- R/D SHOULD MAKE A DIFFERENCE AND BE "USE INSPIRED"
- IDENTIFY "CLIENT" NEEDS
- A TEAM IS NEEDED
- USE REAL WORLD SITE SAMPLES AND SCENARIOS

POSSIBLE FOCUS FOR SUBSEQUENT DISCUSSION

- WHAT KEY HYPOTHESES AND/OR UNCERTAINTIES NEED TO BE EVALUATED TO "MAKE A DIFFERENCE" ?

- NEED A VISION FOR R/D THAT CAN BE TRANSLATED TO ACTION